ecology and environment, inc.
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International Specialists in the Environment

Memorandum

To: Mike Zimmerman
EPA-OSC
From: Mike Sullivan
TAT Region 8
Date: 8/6/92
Subject: Inspection of the Tailings Dam at Richardson Flats T08-9204-015.

Under TDD# T08-9204-015 the U. S. Environmental Protection Agency (EPA) tasked the Ecology & Environment, Inc. Technical Assistance Team (TAT) to inspect the Tailings Dam at the Richardson Flats Tailings Pond near Park City, Utah and to provide a report on the findings of the inspection. The inspection did not encompass any trenching or boring in the embankment which would be required for a full assessment of the structure. This report relies heavily on the two reports generated by Dames and Moore, Inc., and on a visual inspection of the structure. The Dames & Moore reports are "Report of Embankment and Die Design Requirements Proposed Tailings Pond Development Near Park City, Utah for Park City Ventures Corporation" (1974) and "Report on Tailing Pond Investigation near Park City, Utah for Noranda Mining, Inc" (1980).

BACKGROUND

The Richardson Flats Tailings Pond, located near Park City, Utah, was a tailings pond which received slurried mill and mine wastes from mining operations in the Park City area. Tailings were transported to the pond via a slurry pipeline. According to the historical records, Richardson Flats was originally a flat area with intermittent drainages and Silver Creek running across it. The area was somewhat marshy and boggy. The original tailings dam was constructed of organic soils excavated from the site and piled up to form a small berm. Later raises for the embankment were constructed, as needed, out of sands, gravels, organic silts, as well as rubbish and garbage (Dames & Moore, Inc 1974).

In 1974 Dames & Moore, Inc. was contracted by Park City Ventures Corporation, the owners of the mine, to investigate enlarging the tailings pond. Dames & Moore Inc., was to provide design requirements for the proposed embankments with special attention given to minimizing seepage of contaminated pond effluent from the tailings pond. The investigation program consisted of exploratory

boring, test pits, laboratory analysis for strength characteristics of the soils, and analysis of the data to provide design requirements. The report called for construction of a main embankment, a dike along the southern and northern ends of the pond, and construction of a diversion ditch to route runoff away from the pond.

In 1974 the embankments and diversion ditch were constructed, generally in accordance with the requirements as outlined in the Dames & Moore report.

In 1980 Dames & Moore, Inc. again investigated the structure for Noranda Mining, Inc., the new owners of the mine. As stated in the reports introduction the objective of this investigation was to "... assess the overall condition and usefulness of the existing facilities and to determine what measures will be required for long-term tailings disposal from the Park City mine." In this report Dames & Moore noted that enlargement of the embankment had not been ..."built according to recommendations ..." and that the fill was not "...properly engineered during construction.". Specific problems noted by Dames & Moore in the construction of the main embankment included: oversteepened slopes of approximately 1.5:1.0 in many places, no evidence of internal zoning of the embankment (clay core), the recommended drainage zone at the downstream toe was not installed, and that overall compaction of the material in the embankment was poor. Also noted at this time was "... considerable seepage in the form of small seeps and marshy areas on the northwest abutment and at the downstream toe of the main embankment...". The report recommended adding a drainage blanket to the toe of the embankment, flattening the oversteepened slope of the main embankment, and gave construction sequences for adding to the dikes.

FIELD INSPECTION

On August 4, 1992 TATm Sullivan inspected the main abutment of the Tailings Pond. From visual inspection and referencing the cross sections provided in the Dames & Moore report it appears that the dike was raised from the 1980 levels although not to the ultimate design levels. It is probable that the main embankment was also raised at the same time. No data is available on the construction or construction inspection of this last round of construction. The visual inspection also indicated that the oversteepened slope of the main embankment had not been flattened and that the drainage zone at the toe of the main embankment had not been installed.

The Main Embankment-

The main embankment is about 30 feet high with a slope length of approximately 50 feet. The main embankment is oversteep lying at 1.0:1.0 to 1.5:1.0 (run:rise). Approximately 6" of fine dry sand, possibly windblown tailings, was noted under a 3" topsoil cover layer on the downstream face of the embankment. The sand has no

strength and will erode quickly if exposed. A 35% to 50% grass cover was on most of the embankment which will help in erosion control. No cracking was evident on the embankment,although the sand layer would tend to hide any small cracking. Also, no bending (bulging) was noted on the embankment.

Toe of the Main Embankment-

Rank vegetation, in the form of willows and trees, is growing at the toe of the dam. Approximately 8" of loamy damp soils are evident on the toe of the dam. The amount of vegetation and the type of soils on the toe of the dam indicate that the area receives a lot of water. As the wet soils were noted approximately 6 to 8 feet above the stream level this water is probably due to seepage under the dam. Other evidence of seepage from the toe of the dam was evident in the form of; soft marshy areas, rank vegetation including willows, loamy soils, damp soils, and areas where water had been standing (although no standing water was observed on August 4th).

The North Abutment-

A swampy, loamy area on the north abutment, adjacent to where the embankment meets the abutment, was noted. The area was well above the toe of the dam at the location of the north monitoring well. The north abutment well recharged well when bailed. These conditions indicate that water seeps around or through the contact between the abutment and the embankment. Under full head conditions (saturated tailings) this could be an area where failure of the embankment could occur.

Crest of the Main Embankment-

The crest is sloped back toward the tailings pond allowing any water to drain back to the tailings pond. However, small erosional gullies are forming on the crest and downstream face of the dam and could eventually lead to larger gullying on the dam.

Water Flow-

Water elevations behind the embankment are unknown, however the elevation of water in the ditch and the pond south of the tailings pond are probably indicative of the elevation of groundwater behind the embankment. From the information available in the Dames & Moore, Inc. reports, it is unlikely that a cutoff wall was installed around the perimeter of the pond to control seepage under either the embankment or the dike. The piezometer located on the toe of the dam indicated the water level to be 5 feet below ground. The swampy ground and recharge rate of the monitoring well on the north abutment indicates that water flow from some source is occurring. Inspection of the road cut north of the abutment revealed no seeps. Without further investigation it is conservative to use a worst case scenario and assume that the source of the seep is the water in the tailings behind the dam and

that the abutment\embankment contact is a drainage path for the water.

Perimeter Dike-

The perimeter dike was probably constructed by stripping materials off of the downstream side and piling the undifferentiated material up as a dike. The slopes are approximately 2.0:1.0. The dike is used as the access road for the pond and its elevation varies from 2 to 5 feet above the level of the tailings in the pond. The dike appears to be in good condition.

Diversion Ditch-

The diversion ditch has been constructed along the perimeter of the tailings pond as designed by Dames & Moore. The ditch depth and width varies, generally getting deeper and wider as it progresses downstream. Standing water was evident in most of the ditch on the southern perimeter of the property. Rushes, sedges, and cattails were growing in the bottom of the ditch along the entire length. Recent work has been performed by the owners in flattening the ditch banks and adding topsoil to the banks. This work is approximately one-half completed. According to the owners, the rest of the ditch is to be similarly regraded and topsoiled. At the time TAT inspected the site, the hillside diversion ditch, on the north perimeter of the tailings pond, had been cut off from the main ditch as a result of topsoil stripping. This important feature should be reconnected to the main ditch as soon as feasible to prevent additional water flowing into the tailings pond.

CONCLUSIONS

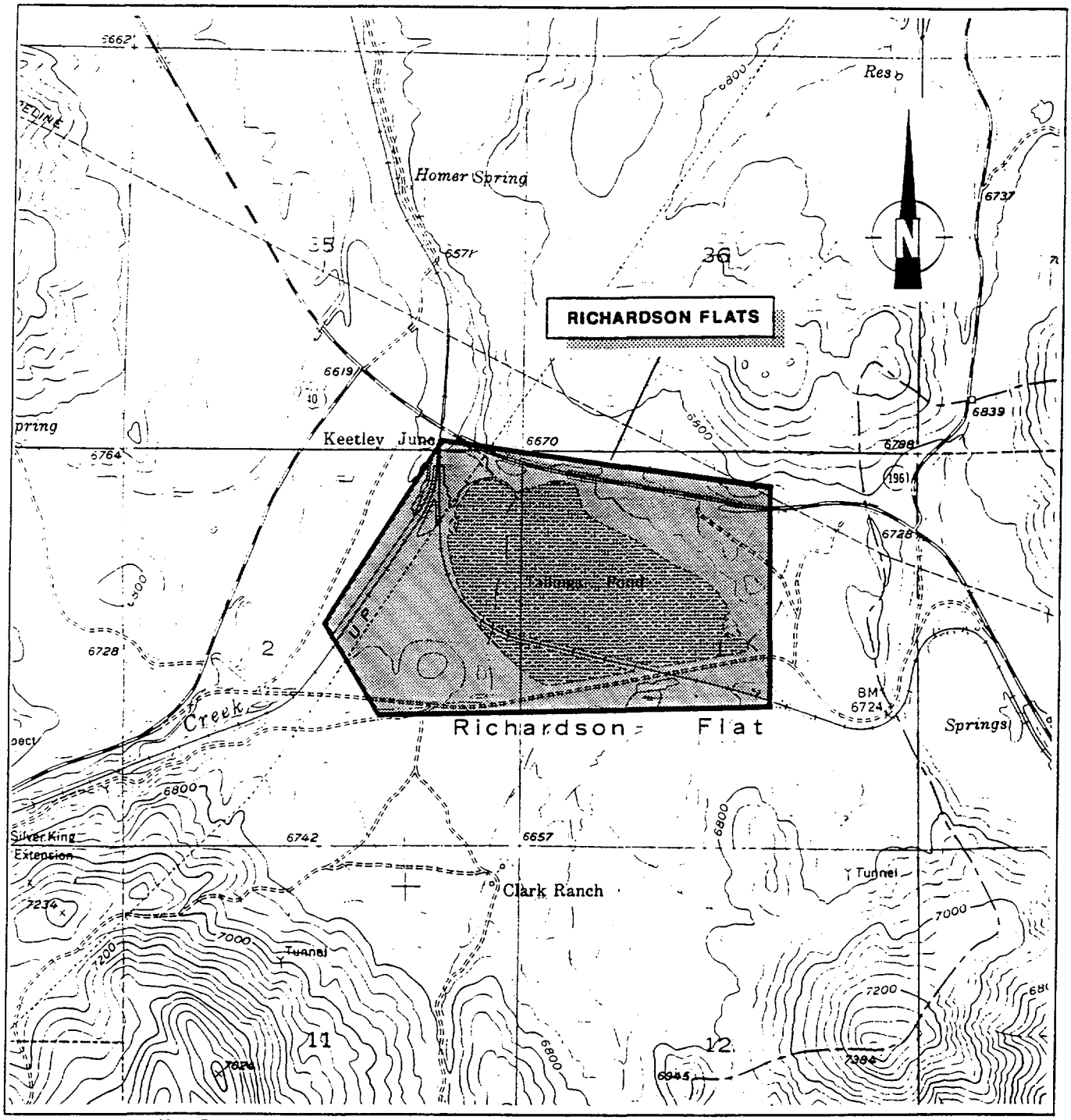
kBased on TATs inspection, the previous investigation conducted by Dames & Moore, and that the tailings pond seems to be essentially dry, there would appears to be no imminent threat of failure of the main embankment. Failure could occur due to the oversteepened nature of the embankment, especially if the embankment becomes saturated due either to saturation of the tailings or to saturation of the embankment itself. A threat exists of undermining of the dam through the uncontrolled seepage areas located along the toe of the main embankment and on the north abutment. Again the threat would be increased if the tailings become saturated thus increasing the head pressure and possibly the velocity of water flow through the seeps.
The property owners are keeping open the option of reactivating the tailings pond. If the tailings pond is reactivated additional recommended actions are noted in paragraph B. below.

RECOMMENDATIONS

A. Keeping the tailings pond dry through the maintenance of the diversion ditches will do the most to prevent failure of the embankment and a possible release of the tailings into the environment. The connection between the hillside diversion

ditch and the perimeter diversion ditch should be restored. In the future, the slopes on the main embankment should be flattened to 2.0:1.0 or greater, and the toe drainage blanket should be installed to allow liquids to drain away from the embankment. A monitoring well should be installed on the top of the tailings pond next to the embankment to monitor the elevation of groundwater within the pond and at the embankment. With water level elevation data available for both upstream of the embankment and at the toe of the embankment better, evaluations of the stability of the structure can be made. If any seeps appear on the embankment they should be monitored for both quantity and quality. Seeps carrying a sediment load generally indicate that active undermining of the embankment may be occurring. Undesirable vegetation in the form of willows and trees should be removed from the embankment.

B. If the pond is to be used for tailings deposition, saturation of the existing tailings is a distinct possibility. With saturation, the possibility of failure of the embankment is raised due to the oversteepened slopes, the existing seeps in the downstream toe of the dam, and the seeps along the north abutment. Saturation of the tailings would increase the head pressure on the seeps, possibly increasing the velocity and amount of water seeping through the embankment. Also, saturation of the tailings will tend to raise the water surface within the embankment itself. Wetting of the material within the embankment can significantly reduce the ability of the material to resist failure. Because the embankment is apparently constructed of undifferentiated materials it would be prudent to add in the drainage blanket at the toe of the embankment and to flatten the embankment as recommended in the 1980 Dames & Moore report. The possibility of a cut-off wall being installed in the embankment should also be investigated. Also, continual monitoring of the seepage from the toe, installation of a network of piezometers and inclinometers is recommended to continually assess the integrity and stability of the embankment.

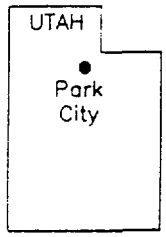


Source: Park City East Quadrangle, Utah. USGS, 1955

0 1/2 1 MILE

1000 0 1000 2000 3000 4000 5000

LOCATION MAP



LEGEND

Site location

TECHNICAL ASSISTANCE TEAM FOR EMERGENCY RESPONSE, REMOVAL AND PREVENTION
EPA CONTRACT 68-WO-0037

TITLE:

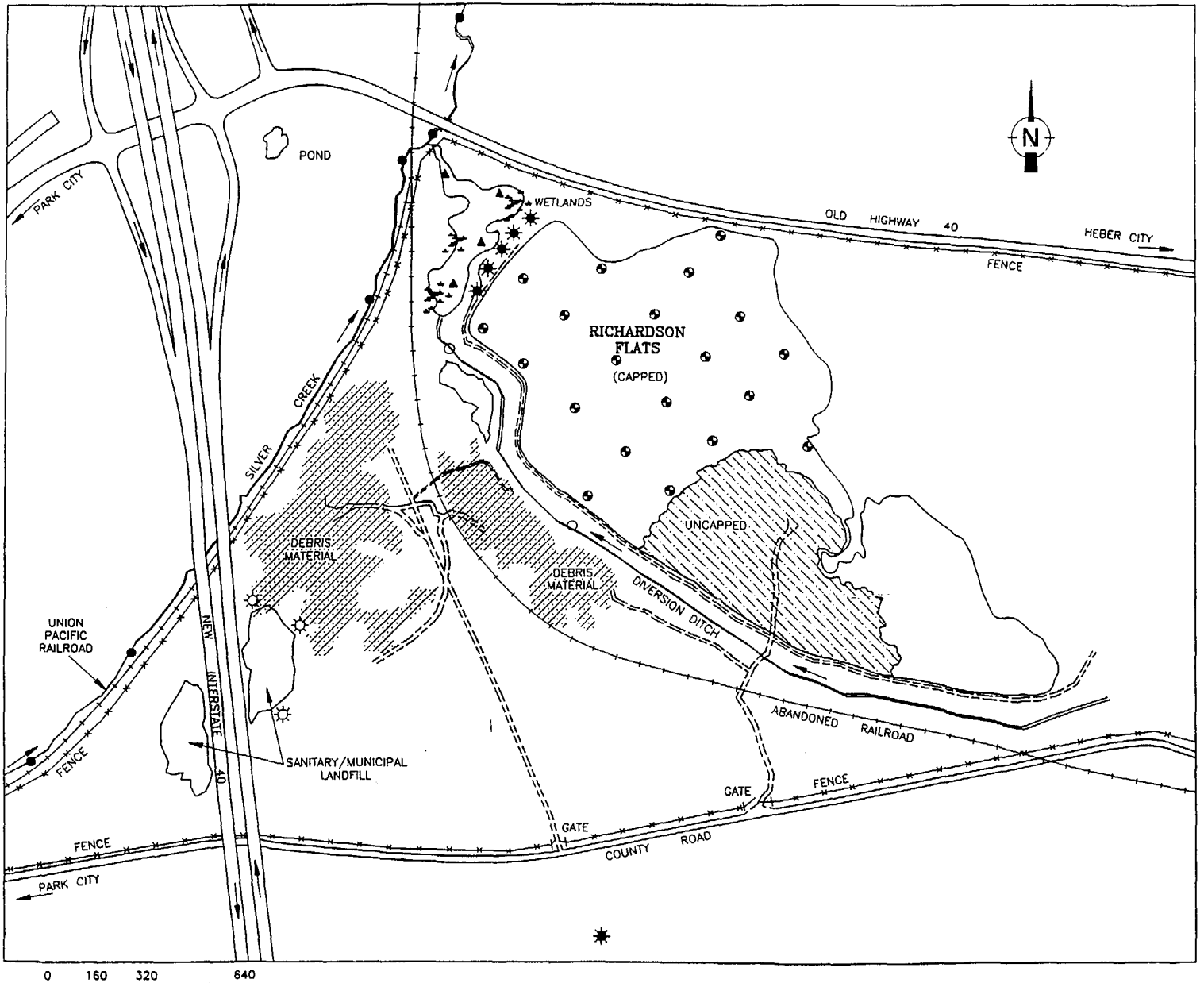
RICHARDSON FLATS
Park City, Utah
SITE LOCATION MAP

T.D.D. T08-9204-015

ecology & environment, inc.
DENVER, COLORADO

FIG. 1

Date: 05/92 Drawn by: RSM Scale:



LEGEND

- Approximate location of existing monitoring wells to be sampled
- Proposed monitoring wells to be installed and sampled
- Location of surface water samples from Silver Creek
- Surface water samples from diversion ditch (Two upgradient locations will be determined at the time of sampling in the Northeast portion of the site)
- Location of sediment samples
- Location of soil boring

Note: All air samples will be collected off site

TECHNICAL ASSISTANCE TEAM FOR EMERGENCY RESPONSE, REMOVAL AND PREVENTION
EPA CONTRACT 68-W0-0037

TITLE:
RICHARDSON FLATS
Park City, Utah
SAMPLE LOCATION MAP

T.D.D. T08-9204-015

ecology & environment, inc.
DENVER, COLORADO

FIG. 2

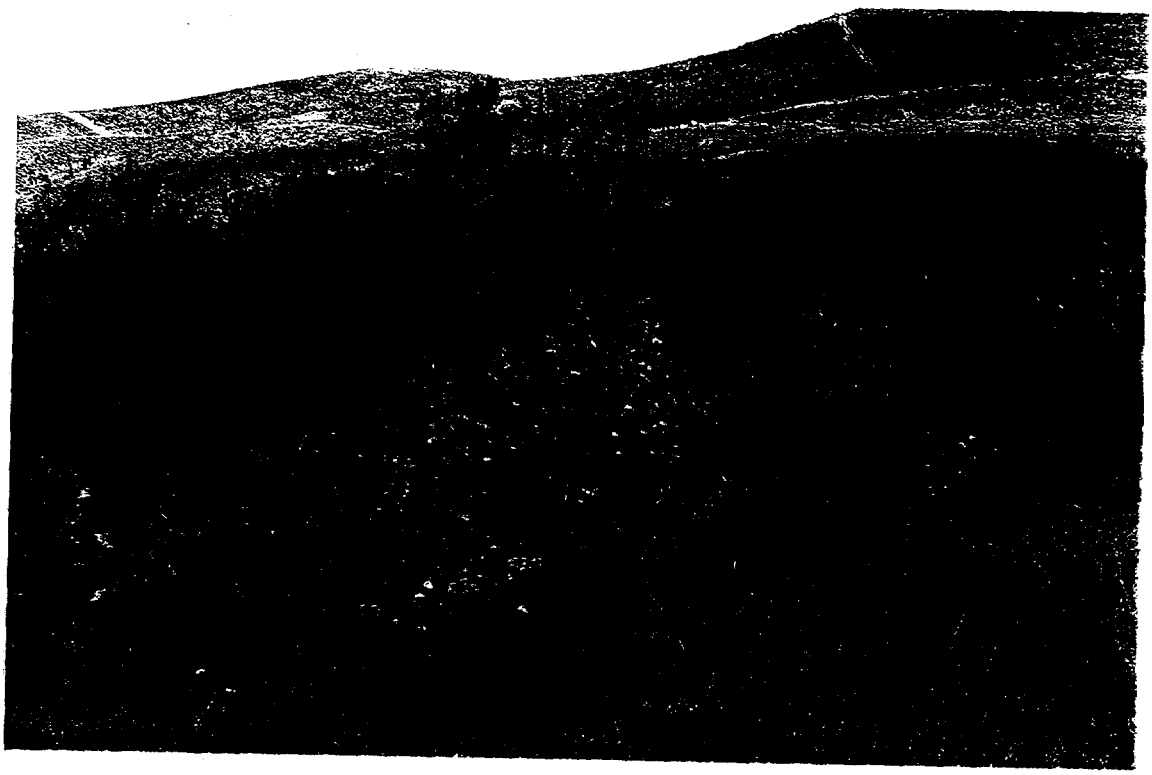
Date: 05/92 Drawn by: RSM Scale:

OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Crest of main embankment from south corner

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1150 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

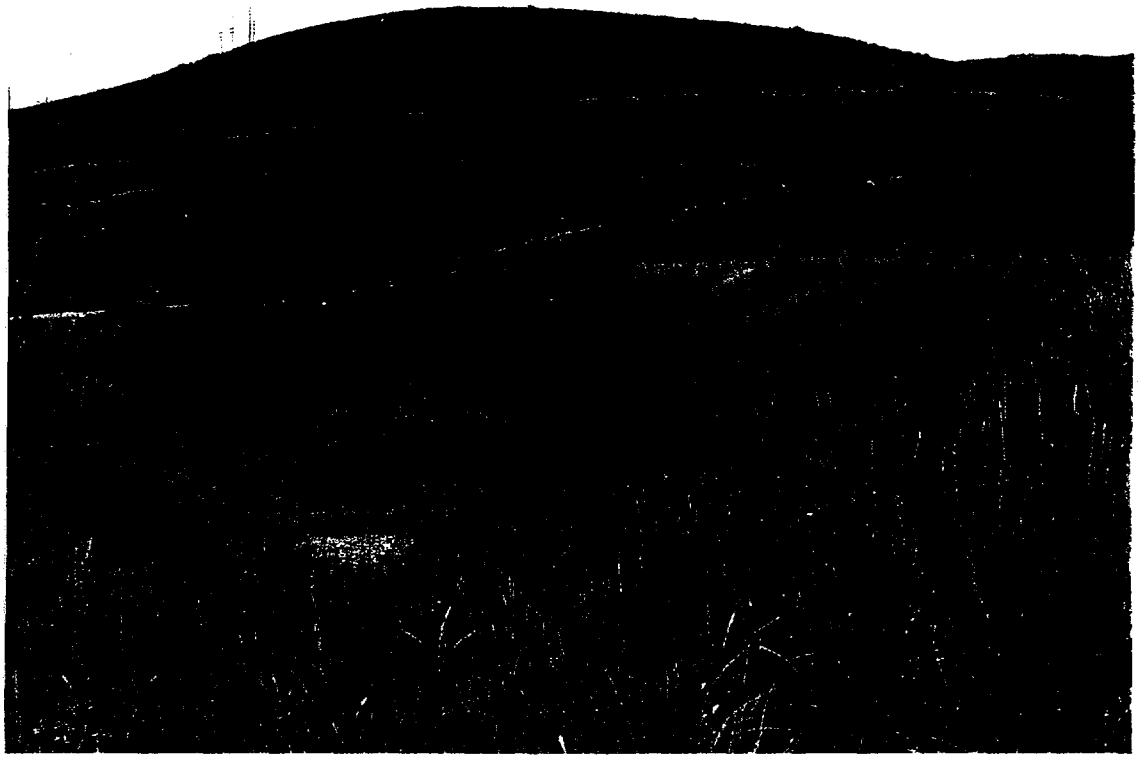


OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Vegetation at toe of main embankment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1210 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA



OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: North half of embankment; steep slope

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1211 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Sand layer (6" thick) on downslope face of embankment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1212 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Heavily vegetated area on toe of main embankment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1213 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Peat development at toe approximately 6" thick

Location: Richardson Flats

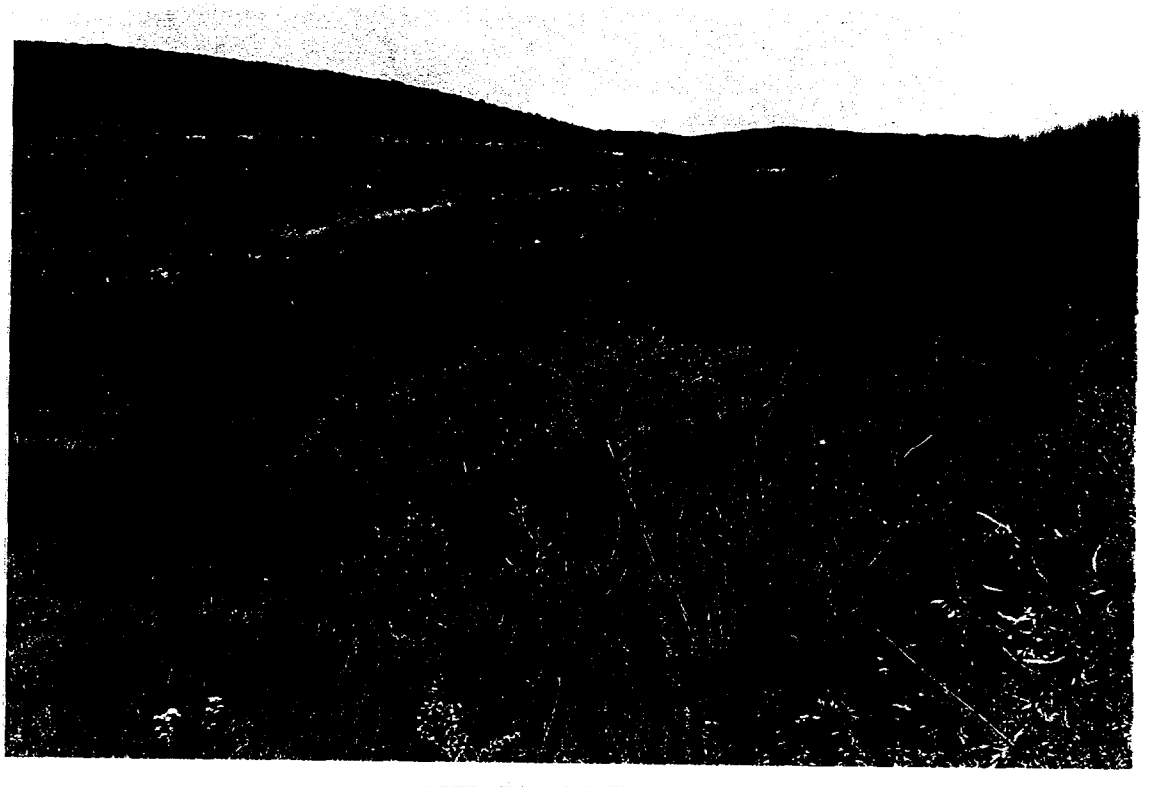
City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1215 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: 6" sand layer under 2-3" topsoil on main embankment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1222 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA



OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Vegetation growing at toe of main embankment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1220 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Old seep area at north abutment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1225 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
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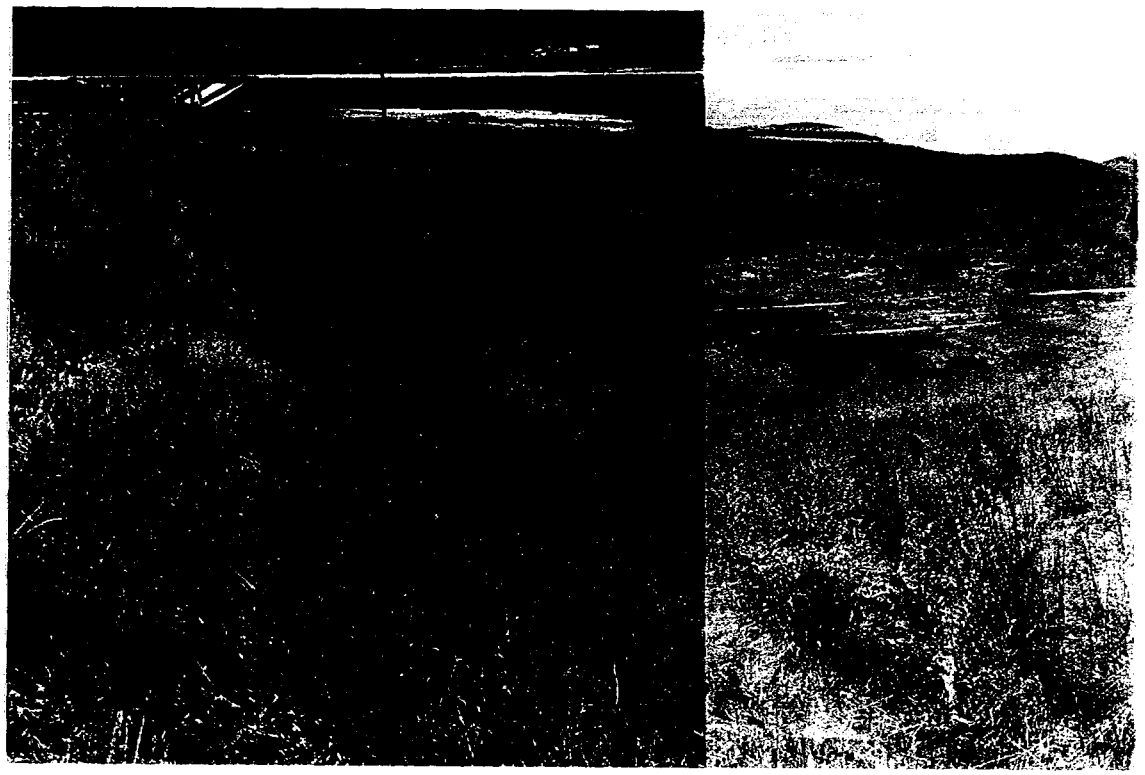
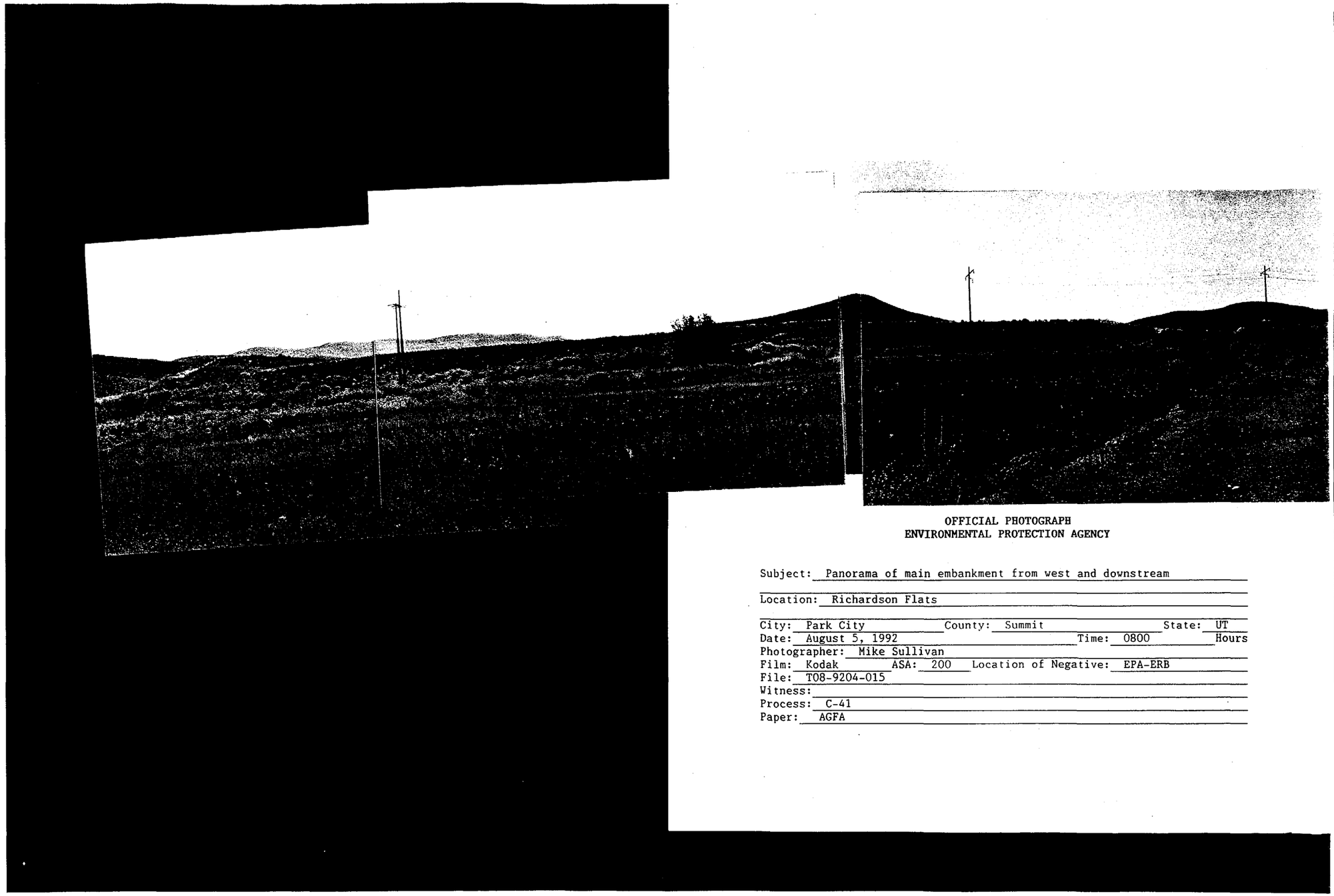


OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Looking south from north abutment

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 4, 1992 Time: 1226 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

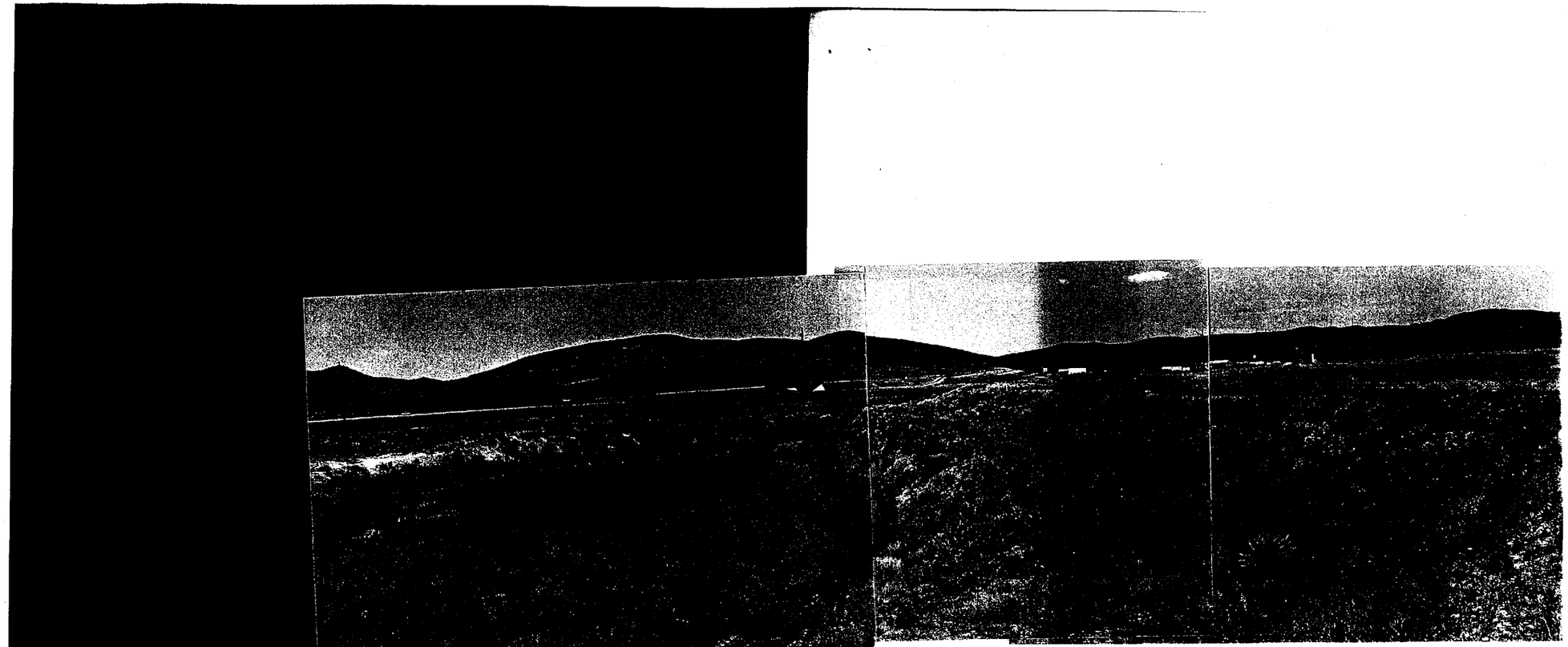


OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: Panorama of main embankment from west and downstream

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 5, 1992 Time: 0800 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

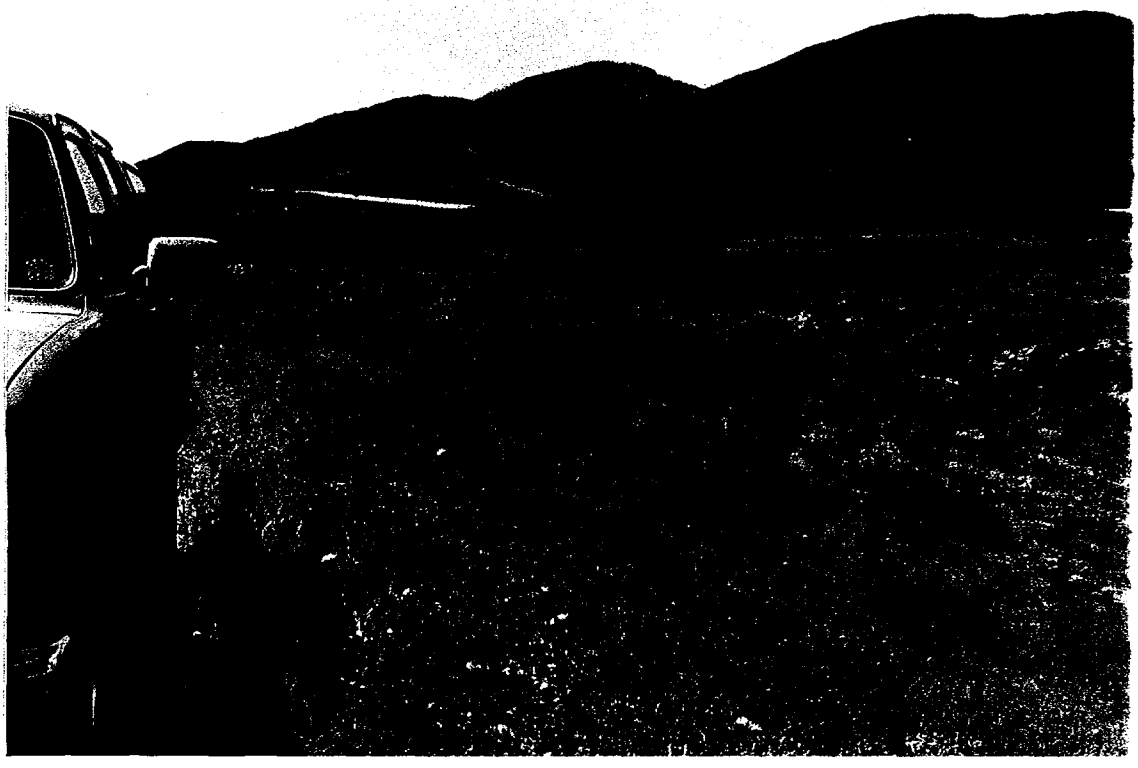


OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: South embankment/dike and barrow pond looking west

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 5, 1992 Time: 1200 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA



OFFICIAL PHOTOGRAPH
ENVIRONMENTAL PROTECTION AGENCY

Subject: South embankment/dike from barrow pond looking east

Location: Richardson Flats

City: Park City County: Summit State: UT
Date: August 5, 1992 Time: 1200 Hours
Photographer: Mike Sullivan
Film: Kodak ASA: 200 Location of Negative: EPA-ERB
File: T08-9204-015
Witness:
Process: C-41
Paper: AGFA

EPA REGION VIII
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID # 7176
PAGE # _____

IMAGERY COVER SHEET
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SITE NAME Richardson Flat Tailings

OPERABLE UNIT _____

REPORT OR DOCUMENT TITLE Inspection of Tailings Dam

DATE OF DOCUMENT 8/6/92

DESCRIPTION OF IMAGERY Color photos

NUMBER AND TYPE OF IMAGERY ITEM(S) ~10 photos